



Animal &
Plant Health
Agency

Livestock
Demographic
Data Group:
Sheep
population
report

Livestock
population density
maps for GB

November 2017





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Contributors	Department of Epidemiological Sciences, APHA Epidemiology and Risk Policy Advice team, APHA Information Management Team Data Systems Group, APHA Small Ruminants Species Expert Group, APHA
Contacts for queries	erpa@apha.gsi.gov.uk
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Contents

Who are these reports for?	1
Who did this work?	1
What do the data show about the population?.....	1
How accurate are the data?	1
What do the data not show?	2
How were the maps produced?	2
Annex 1: Data quality statement for sheep and goats	5
Introduction	5
Overview of source data used.....	5
Overview and purpose of the source data.....	5

Who are these reports for?

These reports are suitable for use in animal health and welfare policy work which requires an estimate of the distribution and size of the sheep population at GB level. This type of population level information is often required to assess the economic or social impact of particular animal health policies, for contingency and resource planning, or to provide evidence to trading partners. There are important assumptions and uncertainties with these estimates which the user needs to take into consideration and can be found at Annex 1.

Who did this work?

The Livestock Demographic Data Groups (LDDG) were formed in January 2014 and are made up of APHA representatives from data, epidemiology, species expert and GIS work groups. The LDDGs are grateful to Defra, Welsh Government, Scottish Government, IBM and APHA Weybridge DSG staff who handled the Sheep and Goat Inventory data and RADAR data warehouse for their assistance in producing this report.

What do the data show about the population?

The maps (Figures 1 and 2) show either the density of animals, with a small map to show how this compares with the density of holdings, or vice versa. As expected, the maps show that the sheep holdings and population of GB is largely distributed across Wales, northern England and southern Scotland, with additional focal areas of high population density in south west and south east England. Although there is a seasonal pattern in movement and numbers of sheep affecting the animal density, with higher numbers in summer reflecting the annual lamb crop, the distribution of the population is similar in the June and January data.

How accurate are the data?

The Sheep and Goat Inventory holds information about the location and animal count of sheep holdings in GB in winter. This is described in the data quality statement and has been represented by the map. The data are derived from approximately 79.2% of all registered holdings that were requested for a return. The characteristics of the 20.5% of non-responders are unknown and the effect of these missing data has not been evaluated.

It is not expected that the fact that England's data is taken a month earlier (December) than Scotland and Wales (January) would have any effect on the map. The supporting quality statement provides further detail on the limitations in the data (Annex 1).

What do the data not show?

The data from the annual Sheep and Goat Inventory will not show the majority of lambs as most are born after the inventory takes place and will be slaughtered prior to the next inventory. Comparison against data from the Agricultural Survey run in June 2010 indicates the sheep population increases by approximately 70% between the dates the surveys are taken.

There is uncertainty inherent in the information displayed. Limitations in the dataset are discussed in the supporting quality statement (Annex 1) and it is important that the user considers these in the context of their work. Population and holding density maps are classified to different scales and units from each other and due care must be taken regarding their interpretation.

How were the maps produced?

The maps have been created using the kernel density function in *ArcGIS software*. This tool distributes population information over a defined radius, creating a smooth density surface. Two key parameters that require adjustment are the *search radius distance* and the size of the *output surface grid*. Discussion at the LDDG meetings informed these criteria, and their selection is recognised as a subjective process¹. A search radius of 15km was deemed sufficient to enable distinction between categories and a 1km grid square was used for the density surfaces themselves. The classification bins were limited to six, to aide in cross referencing areas of the map to the key. Comparison between the maps was optimised by assigning similar parameters between the species. However, further refinement of the parameters for each species' dataset could represent the information more accurately. Note that the ArcGIS Kernel Density tool does not take into account edge effects², and as such density estimates in and around coastal areas may be under estimated.

¹ Pfeiffer, D. Spatial Analysis in Epidemiology, 2008. p47.

² https://www.e-education.psu.edu/geog586/15_p15.html

Figure 1: Sheep population density (Sheep and Goat Inventory)

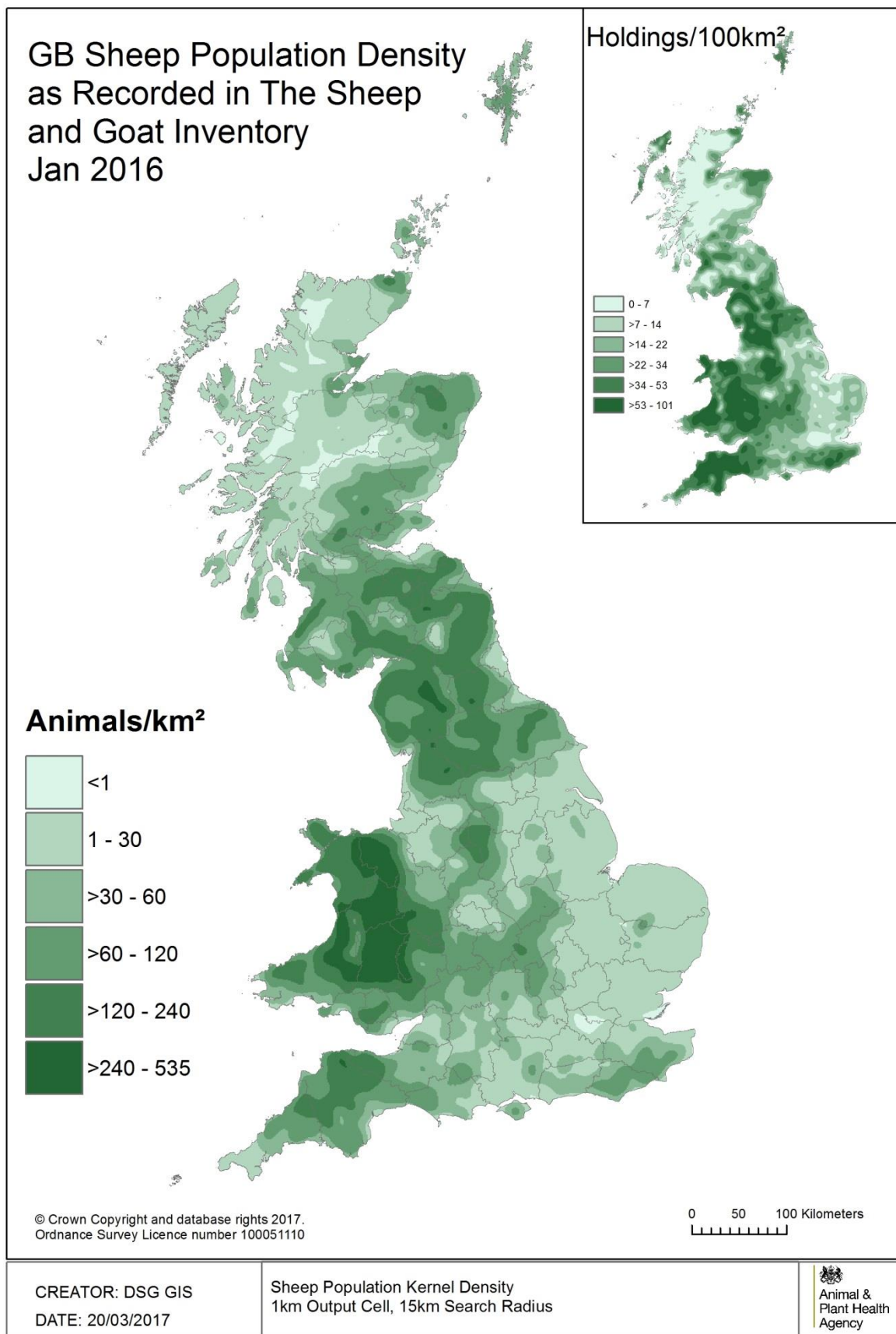
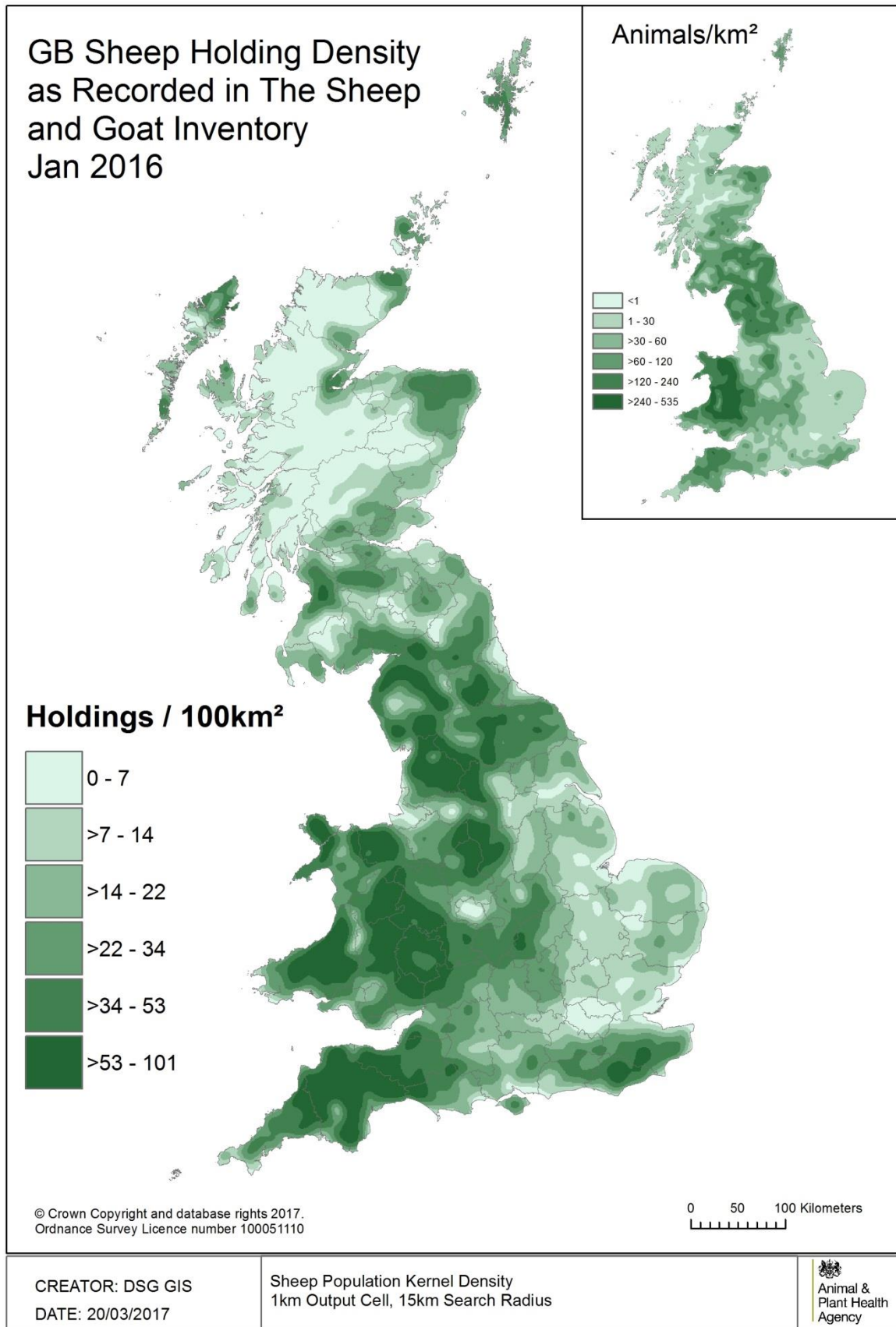


Figure 2: Sheep holding density (Sheep and Goat Inventory)



Annex 1: Data quality statement for sheep and goats

Introduction

This statement provides an overview of the quality of the data used to underpin the kernel density holding and livestock maps. This statement is written in the context of the data being used to provide an overview of the livestock demographics within Great Britain. The statement may not necessarily relate to data quality for other purposes.

Overview of source data used

Data were supplied by the Data Systems Group (DSG), APHA Weybridge and sourced from the Sheep and Goat Inventory via the Rapid Analysis and Detection of Animal-related Risks (RADAR) data warehouse.

Sheep and Goat inventory (via RADAR) was chosen to represent the sheep and goat data as this has the most inclusive coverage on holdings across GB. This dataset records the number of sheep and goats kept on all registered individual premises and the purpose they are kept for e.g. meat, wool, dairy etc. The inventory data is collected once a year (1st December for England and 1st January for Scotland and Wales) by means of questionnaire cards which are sent to every registered holding in GB. This gives a winter count of the population. There is a response rate of between 81 and 84% for each annual survey.

The Agricultural Survey was considered, this data is collected in the summer months and so would include lambing data which would therefore show a much larger population than that in the Sheep and Goat inventory. However this survey only holds data on larger agricultural holding and not small holdings. We therefore decided that the sheep and goat inventory gave a better picture of all holdings. The agricultural survey would still be available if it was decided that a summer count was more relevant. As a rule of thumb, sheep numbers are approximately 70% higher in summer due to the presence of the lamb crop. The Animal Movement Licensing System database (AMLS) was also considered as a source for these data, but this only shows movements on batches of animals and not individual counts and so it decided this was not suitable.

Overview and purpose of the source data

The Sheep and Goat Inventory has records of the number of sheep and goats kept on individual premises and the purpose for which they are kept, for example, meat, wool, and dairy.

Category [definition]	Quality description
<p>Relevance of data</p> <p>[degree to which data meets user needs in terms of currency, geographical coverage, content and detail]</p>	<p>Spatial coverage</p> <p>The data cover GB (England, Scotland and Wales).</p> <p>Temporal coverage</p> <p>The data presented are for December 1st 2015 (England) and January 1st 2016 (Scotland and Wales). The data were accessed in Sep 2016</p> <p>Key data items available</p> <p>The dataset includes species (sheep or goat) and number of animals on holding, purpose of holding, CPH, name and address of keeper/holding.</p>
<p>Timeliness</p> <p>[the degree to which data represent reality from the required time point]</p>	<p>How often are the data collected?</p> <p>The data are collected annually on December 1st for England and January 1st for Scotland and Wales.</p> <p>When does the data become available?</p> <p>The data are available and uploaded into RADAR about 6 months after the survey is collected by the Defra Statistics Team based in York ('York Stats').</p> <p>Data reference period?</p> <p>The data are a snapshot at the date of the survey.</p> <p>How often are the data updated?</p> <p>Data are updated annually.</p>
<p>Accuracy and precision</p> <p>[extent of data error and bias and how well data portrays reality]</p>	<p>How were the data collected?</p> <p>Inventory cards are sent once a year by post to all holdings that registered a sheep or goat and asked to be completed and returned.</p> <p>Sample & collection size</p> <p>All holdings registered with a sheep or a goat are sent a form and is intended as a full census. It is not known how many eligible</p>

	<p>holdings have not registered. The sample size includes all holdings that have returned the inventory form.</p> <p>Further information on rules for registering a holding with a sheep or goat:</p> <p>https://www.gov.uk/sheep-and-goats-identification-registration-and-movement</p> <p>What steps have been taken to minimise processing errors?</p> <p>Further investigation is required to identify what work has been done to review the accuracy of the Welsh and Scottish data. The data collected through the English survey is subject to manual validation to check the data accuracy. Not all data that fails validation can be corrected/confirmed as they cannot always get hold of the keeper. There are a number of different errors that can be detected such as incorrect flock number, to illegible forms. The team check every form and verify the information where possible.</p> <p>What are the response rates?</p> <p>81-84% response rate for surveys between 2013 and 2015</p> <p>Are any parts of the population unaccounted for in the data collection?</p> <p>The Defra Statistics Team do not receive returns from around 16% of holdings surveyed, however it is not known whether non-responders represent particular parts of the population. There may also be holdings that are not registered, and so are unknown.</p>
<p>Comparability</p> <p>[how well these data can be compared with data taken from the same dataset and with similar data from other sources]</p>	<p>Within dataset comparability</p> <p>The format and survey methods are similar between years. Comparison of the data across previous years indicates sheep populations appear to have increased slightly each year.</p> <p>Other dataset comparability</p> <p>The data compares with Agricultural survey which shows data collected in the summer but this also includes lamb populations. AMLS holds movement data which can compare knowledge of holding locations however both datasets have a difference in data capture.</p>
<p>Coherence</p>	<p>How consistent is the data over time? If there are differences,</p>

<p>[degree to which data can be or have been merged with other data sources]</p>	<p>what are they and what is their impact? Have there been changes to the underlying data collection?</p> <p>The sheep population was split into ‘breeding and ‘other’ a couple of years ago otherwise no major changes in the data itself. We are unaware of any changes to the data collection that could potentially impact the representativeness of the dataset.</p> <p>Have any real world events impacted on the data since the previous release?</p> <p>No</p> <p>What other data sources is this data comparable with?</p> <p>Agricultural survey for total population, Animal Movement Licensing System (AMLS) for total holdings.</p> <p>What other data sources in society report similar information? How do these data sources compare?</p> <p>Industry has their own datasets but these are obtained from, for example, the sheep and goat inventory and Agricultural Survey. It is thought they are unlikely to offer any additional information.</p>
<p>Interpretability</p> <p>[how well the data is understood and utilised appropriately]</p>	<p>Is there a particular context that this data needs to be considered within?</p> <p>This is a winter survey and as sheep form a seasonal dynamic population the numbers will be much higher during the summer post lambing.</p> <p>What other information is available to help users better understand this data source?</p> <p>There is a metadata catalogue for RADAR available at http://ahvlaintranet/day-to-day/tools-and-applications/Pages/radar.aspx</p> <p>Are there any ambiguous or technical terms that may need further explanation?</p> <p>No.</p>
<p>Accessibility</p>	<p>What data are shared and with whom?</p> <p>Unknown, DSG access data through RADAR or directly from York Stats, personal information cannot be published.</p>

[availability of relevant information and access to the data in a convenient and suitable manner]

For further information on the data sources:

RADAR@AHVLA.GSI.GOV.UK